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Proceedings for the 8th Annual

Urban Ecology and Conservation Symposium

Organized by the

Urban Ecosystem Research Consortium

January 25, 2010

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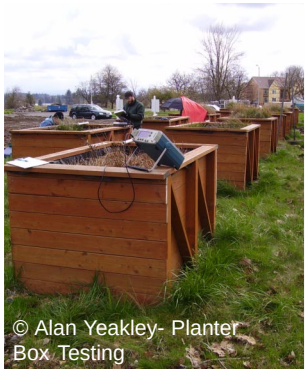

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8TH ANNUAL

URBAN ECOLOGY & CONSERVATION SYMPOSIUM

Organized by the
Urban Ecosystem Research Consortium (UERC)

Held at
Smith Memorial Center Ballroom
Portland State University
Portland, Oregon, USA
January 25, 2010

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URBAN ECOSYSTEM RESEARCH CONSORTIUM (UERC)
PORTLAND – VANCOUVER METROPOLITAN REGION

What is the UERC?

The UERC is a consortium of people from various universities and colleges, state and federal agencies, local governments, non-profit organizations and independent professionals interested in supporting urban ecosystem research and creating an information-sharing network of people that collect and use ecological data in the Portland/Vancouver area. Participants come from a variety of fields, including:

air quality	*education*	*hydrology*	*stormwater management*
conservation	*environmental design*	*land management*	*sustainable development*
biology	*fisheries*	*land use planning*	*transportation*
ecology	*geology*	*social sciences*	*water quality*
economics	*habitat restoration*	*soil science*	*wildlife biology*

Mission Statement - To advance the state of the science of urban ecosystems and improve our understanding of them, with a focus on the Portland/Vancouver metropolitan region, by fostering communication and collaboration among researchers, managers and citizens at academic institutions, public agencies, local governments, non-profit organizations, and other interested groups.

Goals and Objectives

- Provide direction and support for urban ecosystem research
- Create an information-sharing network within the research community
- Track and house available information
- Promote greater understanding of urban ecosystems and their importance

Organizers - The principal organizers span academic institutions, government agencies (city, regional, state and federal), private firms and non-profit organizations. Individuals from the institutions listed below have served on the steering committee. The diverse backgrounds and affiliations of those involved have allowed the UERC to bring together many important sectors of the natural resources community.

Audubon Society of Portland
City of Portland
City of Vancouver
Earthworks
Herrera Environmental Consultants
ICF Jones & Stokes
Lewis & Clark College
Metro
Mount Hood Community College
Oregon Dept of Fish and Wildlife
Oregon State University
Portland State University
Reed College
Tualatin Hills Parks & Recreation District
U.S. Fish and Wildlife Service
Urban Greenspaces Institute

Web Site - The UERC web site can be found at **www.uercportland.org**. There, you will find background and contact information, a link to sign up on the listserv, announcements about upcoming events, and full details about annual symposia, including downloadable proceedings.

Listserv - Oregon State University hosts a listserv designed for members to share information and facilitate communication among those interested in urban ecology. Anyone can join by going to the UERC web site and following the link "Join Our Listserv."

Advocacy Statement - The role of the UERC is not to provide a political or advocacy platform, but rather to foster communication and collaboration by offering a forum for professionals to exchange and discuss information regarding urban ecology and its application to relevant fields.

SYMPOSIUM SUPPORT

Urban Ecosystem Research Consortium Symposium Planning Committee

Bruce Barbarasch
Tualatin Hills Park & Recreation District
(503) 629-6305 x2950, bbarbara@thprd.com

Josh Caplan
ICF Jones & Stokes
(503) 525-6149, jcaplan@icfi.com

Josh Cerra
Herrera Environmental Consultants
(503) 228-4301 x110, jcerra@herrerainc.com

Amy Chomowicz
City of Portland, Bureau of Environmental Services
(503) 823-5323, amyc@bes.ci.portland.or.us

Ted Hart
Portland State University, Environmental Science
(541)760-9389, hartt@pdx.edu

Lori Hennings
Metro, Sustainability Center
(503) 797-1940, hennings@metro.dst.or.us

Mike Houck
Urban Greenspaces Institute
(503) 319-7155, mikehouck@urbangreenspaces.org

Noelwah Netusil
Reed College, Department of Economics
(503) 517-7306, netusil@reed.edu

Bob Sallinger
Audubon Society of Portland
(503) 292-9501, bsallinger@audubonportland.org

Cory Samia
Vancouver Water Resources Education Center
(360) 487-7112, Cory.Samia@ci.vancouver.wa.us

Jennifer Thompson
U.S. Fish and Wildlife Service, Oregon State Office
(503) 231-6179, jennifer_thompson@fws.gov

Alan Yeakley
Portland State University, Environmental Science
(503) 725-8040, yeakley@pdx.edu

In-kind support provided by

*We also wish to thank **Metro** for donating their printing services, and the **City of Portland, Environmental Services** and **U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office** for the assistance of **Marjorie Brown** and **Melissa Kennedy** at the symposium.*

Financial support provided by

Audubon Society of Portland
Bureau of Environmental Services, City of Portland
Metro
Urban Greenspaces Institute

2010 Urban Ecology & Conservation Symposium Agenda

8:00 **REGISTRATION**

9:00 **WELCOME AND INTRODUCTION:** Lori Hennings

9:10 **OPENING KEYNOTE ADDRESS: Paul Beier**, Northern Arizona University
An Overview of Science-based Approaches to Wildlife Linkage Design

TERRESTRIAL WILDLIFE *Moderated by: Jennifer Thompson*

9:50	Rachel Kutschera	Portland State University - Environmental Science & Management	Turtle Conservation in an Urban Environment via Habitat Assessment
10:00	Mary Coolidge	Audubon Society of Portland - Conservation	BirdSafe Portland: Assessing the Magnitude of Bird Window Strikes in the City of Portland, September 2009
10:10	Leslie Bliss-Ketchum	Portland State University - Environmental Science & Management	The Effectiveness of Vertebrate Passage and Prevention Structures: a Study of Boeckman Road in Wilsonville
10:20	Claire Puchy and Lisa De Bruyckere	City of Portland - Bureau of Environmental Services	Invasive Animal Assessment
10:30	Max Smith	USDA Forest Service Rocky Mountain Research Station & Oklahoma Biological Survey	Monitoring Willow Flycatchers at Killin Wetlands: Implications for Habitat Restoration

10:40 Q&A

10:50 Break *Raffle at 10:55*

VEGETATION AND HABITAT *Moderated by: Cory Samia*

11:00	Denisse Fisher	Portland State University - Environmental Science & Management	Phase II of the Urban Forestry Assessment and Evaluation for the Portland-Vancouver Region
11:10	John Christy	Oregon Natural Heritage Information Center	Urbanizing Flora of Portland, Oregon, 1806-2008
11:20	Amber Ayers & Marcia Holt-Kingsley	Metro Native Plant Center	Tracking Phenological Developments of Native Wildflowers at Cooper Mountain Nature Park
11:30	Daniel Covington	Mason, Bruce & Girard, Inc.	ODOT's Riparian and Wetland Mitigation Legacy: a Strategic Learning Opportunity
11:40	Kate Holleran	Metro - Science and Stewardship	Lessons Learned in the Acquisition and Stabilization of New Natural Areas

11:50 Q&A

12:00 **LUNCH** *Raffle at 12:55*

1:00 **AFTERNOON KEYNOTE ADDRESS: Mary Cadenasso**, University of California, Davis
Integrating the Baltimore landscape: ecological and social implications of linking tree canopy and water quality

FISH AND AQUATIC WILDLIFE *Moderated by: Josh Cerra*

1:40	Chris Prescott	City of Portland - Bureau of Environmental Services	Effect of Urban Land Use on Macroinvertebrate Community Composition in Tryon and Fanno Creeks
1:50	Josh Caplan	Jones & Stokes - Biometrics	Status and Trends of Salmonid Potential in Johnson Creek: 2000-2009
2:00	David Kennedy	Portland State University - Environmental Science & Management	A Sample of Native Freshwater Mussels on the Middle and Upper Columbia Slough in Portland, Oregon
2:10	Brook Silver	U.S. Fish and Wildlife Service - Columbia River Fisheries Program Office	Tryon Creek Restoration Monitoring of Fish Distribution, Abundance and Connectivity
2:20	Meghan Young	City of Portland - City Nature - Environmental Education	Pond-breeding Amphibians in the City: Occurrence, Influential Factors, Recommendations, & Educational Outreach in Portland, Oregon

2:30 Q&A

2:40 Break

STORMWATER AND HYDROLOGY *Moderated by: Amy Chomowicz*

3:00	Alan Yeakley	Portland State University - Environmental Science & Management	Assessment of Rainwater Detention Structures for an Urban Development in Wilsonville, Oregon
3:10	Karl Lee	U.S. Geological Survey - Oregon Water Science Center	Hydrologic Analyses Supporting Assessment of Land-use Changes in the Johnson Creek Basin, in the Portland Oregon Metropolitan Area
3:20	Lily House-Peters	Portland State University - Geography	Impacts of Urban Design and Vegetation Characteristics on the Surface Energy Budget in Hillsboro, Oregon
3:30	Brian Fletcher	Portland State University - Environmental Science & Management	Downspout Disconnection Suitability and Incentive Analysis for the City of Gresham, Oregon

3:40 Q&A

3:50 **WRAP UP** *Closing remarks by Bruce Barbarasch*

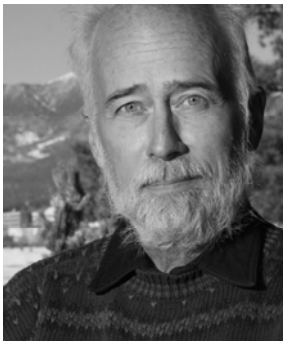
4:00 – 6:00 POSTER SESSION AND SOCIAL

POSTER PRESENTATIONS

PRESENTER	AFFILIATION	POSTER TITLE
Caleb Arata	Reed College - Chemistry Department	Nitrogen dioxide (NO_2) air pollutant concentrations in Portland's atmospheric outflow
Meghan Ballard	SOLV - Team Up for Watershed Health	SOLV's Green Team Program
Janet Bebb	Metro - Sustainability Center	Intertwine Coalition
Kristin Day	Landscape Architecture	Collaborative prospects: school landscapes as catalysts for urban sustainability
Corie Harlan	Metro	Nature in Neighborhoods' Integrating Habitats design competition
Noah Jenkins	Johnson Creek Watershed Council	A Solution to in-line Ponds; achieving fish passage and habitat restoration
Billy Johnson	City of Salem - Stormwater Services	Urban watershed management: City of Salem's Stream Cleaning Program
Jennifer Karps	City of Portland - Bureau of Environmental Services	Planting trees for clean rivers; the Grey-to-Green urban canopy effort
Christine Kendrick	Portland State University	Investigation of traffic dynamics, mode of travel and urban form on human exposure to air pollutants in transportation microenvironments
Ted Labbe	DEPAVE - CityRepair	Project DEPAVE: Community re-greening in action!
Andrea Melnychenko	Portland State University - Biology	Understanding the relationship between ornamental plants and air quality in urban ecosystems: A study of isoprene emission in bamboo
Dawn Nilson	AMEC Earth & Environmental	Shedding light on an urban ecology menace: light pollution
Jason O'Brien	Oregon Master Naturalist Program - Oregon State University Forestry & Natural Resources Extension	Introducing the new Oregon Master Naturalist Program
Gretchen Rollwagen-Bollens	Washington State University Vancouver - School of Earth & Environmental Sciences	Assessing the role of micro- and mesozooplankton grazing on the development and decline of a noxious cyanobacteria bloom in Vancouver Lake, WA

POSTER PRESENTATIONS (cont.)

PRESENTER	AFFILIATION	POSTER TITLE
Gretchen Rollwagen-Bollens	Washington State University Vancouver - School of Earth & Environmental Sciences	Partners in Discovery GK-12 Project at WSU Vancouver: Bridging Research and Teaching about the Columbia River - From Cascades to Coast
Chris Runyard		Plastic waters
Trevor Sheffels	Portland State University - Environmental Science & Management	Nutria (*Myocastor coypus*) herbivory mitigation at a habitat restoration site within the Delta Ponds wetland complex in Eugene, Oregon
Robert Spurlock	Metro - Sustainability Center	Habitat-sensitive trail planning
Elaine Stewart	Metro - Sustainability Center	Ecological Performance Measures for Natural Area Acquisitions
Erica Timma	City of Portland - Bureau of Environmental Services	Landscapes for Rain: The Art of Stormwater
Naomi Tsurumi	City of Portland - Bureau of Environmental Services	Tabor to the River - Integrating Grey and Green Infrastructure
Daniel Uthman	Portland State University - Geography	Spatial distribution of wildlife in the City of Portland
Maya Villarreal	AMEC Earth & Environmental	Ecological Restoration at a Remediated Site



MORNING KEYNOTE ADDRESS

Paul Beier
Professor of Conservation Biology
School of Forestry, Northern Arizona University
Flagstaff, Arizona

An overview of science-based approaches to wildlife linkage design

Wildlife linkages may not be the best or only way to conserve connectivity, but are appropriate where we cannot conserve an intact landscape or manage the entire matrix for permeability. At the regional scale, linkage design includes 4 tasks that are sequential in concept, if not in practice: (1) defining natural landscape blocks throughout a state or region and developing a map of 'fuzzy' linkages between neighboring blocks, (2) prioritizing linkages, (3) developing optimum linkage designs for priority linkages, and (4) evaluating practical alternatives to the optimum linkage design. For each task, planners can use 1 or more science-based approaches, namely expert workshops, least-cost modeling, individual-based movement models, graph theory, spatially-explicit population modeling, circuit theory, simulated annealing, and network flow. No single approach can do all 5 tasks. Least cost corridor (not path) modeling has been the best workhorse for creating regional maps and producing optimum linkage designs. Circuit theory and individual-based movement models are emerging tools for these 2 tasks. One weakness of least-cost modeling, circuit theory, and individual-based movement models is that they depend on a resistance map that is usually based on expert opinion. Graph theory has been the best tool for prioritizing; circuit theory is an emerging competitor for this task. Despite limitations, each science-based approach has the following virtues: it makes assumptions explicit, it can be improved as underlying data (especially the resistance map) are improved, and it helps implementers focus on desired ecological flows rather than other constraints.

Biography

Dr. Paul Beier conducts research in wildlife ecology and conservation biology with a focus on conservation planning at landscape scales. His 1988-1992 study of cougars is best known for its documentation that cougars during juvenile dispersal use habitat corridors through urban areas to become breeding adults in distant mountain ranges. Since then he has worked in California and Arizona to promote science-based efforts to maintain wildlife corridors on large regional scales. These alliances among state and federal agencies, local planning agencies, and conservation organizations are not trying to slow down the rate of fragmentation, but to improve connectivity for wildlife and ecosystem processes.

Dr. Beier has also studied Mexican spotted owls, northern goshawks, and forest bird communities in the U.S. and West Africa. Since 2000, he has worked with traditional chiefs in West Africa to create and manage community-based wildlife sanctuaries for hippopotamus, elephants, and rare forest birds. He also serves on the Recovery Team for the endangered ocelot population in Texas.

He serves as a Science Advisor to the Western Governors Association on their Wildlife Corridors Initiative. In addition, he serves on the Board of Governors of the Society for Conservation Biology. In this capacity, he chaired the effort that produced the Society's first Code of Ethics, and helped to make the Society for Conservation Biology the first society of professional ecologists to take responsibility for its greenhouse gas emissions. His website is: oak.ucc.nau.edu/pb1/.

AFTERNOON KEYNOTE ADDRESS

Mary Cadenasso
Assistant Professor
Department of Plant Sciences
University of California, Davis

Integrating the Baltimore landscape: ecological and social implications of linking tree canopy and water quality

Ecological, physical and social processes that occur on land influence sediment, nutrient, and pollutant input to receiving waters. The Chesapeake Bay has been declared an impaired waters by the U.S. Environmental Protection Agency and the EPA has mandated a 40% decrease in nitrate inputs, a common water pollutant, by 2011. Non-point sources from the landscape are a significant contributor to nitrate inputs. These types of inputs are inherently difficult to control through regulation and require many small and distributed actions. The riparian zone is the boundary between the terrestrial and aquatic components of the system and it may function to control the movement of nitrate across these land-water interfaces. Research from agricultural and forested systems has concluded that intact ecological processes in riparian zones prevent nitrate from entering streams. These processes may be altered, however, in urban landscapes. Current research in the urbanized Gwynns Falls watershed that drains through the City of Baltimore and into the Chesapeake Bay has found that riparian zones function as sources of nitrate rather than sinks. This calls into question the likely success of expanding riparian buffers in urban landscapes as a mitigation strategy for nitrate retention. Instead, a reconceptualization of riparian zones is required such that the land-water interface is not spatially restricted to the discrete zone next to streams but rather is envisioned more spatially distributed throughout the catchment. This reconceptualization allows for a broader range of solutions available to prevent nitrate transport to the Chesapeake Bay that include influencing ecological, physical and social processes in the catchment.

Biography

Dr. Mary Cadenasso is an Assistant Professor in the Department of Plant Sciences at the University of California, Davis where she teaches *Urban Ecology* and *Ecosystems and Landscape Ecology*. She is broadly interested in linking landscape structure to ecosystem function. In her research she uses a variety of tools, from analytical chemistry and remote sensing, to explore this link across systems and scales. Dr. Cadenasso's current research includes: (1) developing a new urban land cover model; (2) exploring the influence of the design of residential neighborhoods on water quantity and quality; (3) quantifying nitrogen deposition into remnant California oak savannas along a gradient of urbanization and assessing its impact on plant-plant and plant-soil interactions; and (4) investigating the role of riparian zones in controlling the movement of animals and nutrients between upland savannas and ephemeral rivers in Kruger National Park, South Africa. She is a co-Principal Investigator on the Baltimore Ecosystem Study, a LTER program, and is extending that work to the Sacramento metropolitan region.

Dr. Cadenasso earned her B.S. at the University of Santa Clara, and, after working for several years as a consultant in the San Francisco Bay Area, earned her Ph.D. at Rutgers University.

ABSTRACTS SUBMITTED

Cain Allen

Friends of Trees - Neighborhood Trees Program, 3117 NE ML King Jr Blvd, Portland, OR 97212
Phone: (503) 282-8846 x13, Email: caina@friendsoftrees.org

Street tree survival and suitability in the Portland metropolitan area

Friends of Trees, a Portland-based non-profit tree-planting organization, has played a significant role in shaping the urban forest of the Portland metropolitan area for more than twenty years. While Friends of Trees monitors newly planted street trees during their first summer, there is little information about long-term survival and suitability. To help fill this information gap, data was collected on the condition, size, structure, and location of more than 2,000 street trees, nearly 10% of the street trees planted by Friends of Trees between 1989 and 2008. The sample consisted of approximately 90 species from 48 different genera. The first-year survival rate of street trees planted by Friends of Trees is 96.3%, the 5-year survival rate is 92.2%, the 10-year survival rate is 79.1%, and the 15-year survival rate is 76.1%. Suitability was also determined for 41 species and cultivars based on condition, structure, and growth rate. Particularly good performers include northern red oak, Prairifire crabapple, Red Sunset maple, Washington hawthorn, and Pacific Sunset maple. The worst performers include Crimson Sentry maple, Japanese tree lilac, Blireiana plum, Japanese hornbeam, and eastern redbud.

Keywords: Land/watershed management, Plant ecology
Website: www.friendsoftrees.org

Allen Amabisca[a], Cherry Amabisca[b], Carol Chesarek[c]

[a]Phone: (503) 647-5334, Email: allen@helvetia.us
[b]Phone: (503) 647-5334, Email: cherryamabisca@gmail.com
[c]Phone: (503) 784-0910, Email: ccaux@earthlink.net

Citizen science: Documenting Roosevelt elk and Oregon white oaks

Did you know that there are Roosevelt elk within 15 minutes of downtown Portland? Or that there are almost 4000 Oregon White Oak trees with diameters up to 72" in the Helvetia area? In 2006, Forest Park Neighborhood started collecting data about wildlife using the areas around Forest Park. The neighborhood wanted to have credible data for the next time the area was considered for urban expansion. We collected and mapped information about areas used by elk in the recent past, and asked interested neighbors to record new sightings of elk and habitat sensitive bird species. In 2009, the Helvetia area was targeted by City of Hillsboro for urban expansion through the regional urban and rural reserves process. The only natural resources in the Natural Features Inventory for the Helvetia area were floodplains. So the citizen group SaveHelvetia worked with local residents to document and map elk and Oregon White Oaks. These combined efforts found groups of up to 90 elk using virtually all of the rural land north of Hwy 26 and south of Hwy 30. Information was collected using simple tools. Email, personal connections, and neighborhood gatherings were used for outreach. Topographical maps with stick on dots, simple spreadsheets, and photographs were used to record the data. Some of the data has been translated into GIS for use by CWS and Metro. Local residents value wildlife and often observe them closely. Neighborhood contacts can provide access to private lands and valuable information about natural resources.

Keywords: Land use planning, Plant ecology, Wildlife biology

Caleb Arata[1a], Juliane Fry[b], Linda George[2c]

[1]Reed College - Chemistry Department, 3203 SE Woodstock Blvd, Portland, OR 97202
[2]Portland State University - Environmental Science & Management, PO Box 751- ESM, Portland, OR 97207
[a]Phone: (310) 968-8331, Email: aratac@reed.edu
[b]Phone: (503) 781-4951, Email: fry@reed.edu
[c]Phone: (503) 725-3861, Email: georgel@pdx.edu

Nitrogen dioxide (NO_2) air pollutant concentrations in Portland's atmospheric outflow

Nitrogen dioxide (NO_2) is a combustion-related air pollutant that forms ozone and nitric acid in the atmosphere, both of which are harmful to ecosystem and human health. The timescale of NO_2 decay in an urban plume was studied by measuring NO_2 levels in and around Portland Oregon in the summer of 2009. Summer wind flow in the Columbia River Gorge (CRG) is overwhelmingly inland and upgorge, carrying Portland air eastward along the river. Average NO_2 concentrations over a two week period were measured with passive diffusion samplers at eleven sites along the CRG beginning in the Portland metro area and extending 175 miles east. The NO2 concentrations from these samplers were compared with fast time resolution data from two chemiluminescence NO_x measurement sites, one located in the metro area and the other 20 miles east along the CRG. The data suggest that both local and upwind sources are important for NO_2 levels in the Gorge.

Keywords: Air quality, Transportation

Meghan Ballard

SOLV - Team Up for Watershed Health, 5193 NE Elam Young Parkway, Hillsboro, OR 97124
Phone: (503) 844-9571 x323, Email: meghan@solv.org

SOLV's Green Team program

SOLV's Team Up For Watershed Health program addresses the growing need for habitat restoration work and education in our urban watersheds. The program now has more than 70 priority stream and wetland restoration and enhancement sites in the Portland metro area. They are located in urban watersheds impacted by huge amounts of impervious surface, untreated storm water and loss of riparian vegetation. One of the most successful aspects of this program is Green Team. Green Team is a year-long service-learning program which engages hundreds of high school and middle school students from 11 different schools throughout the metro area in learning about stream and wetland restoration as well as community leadership and laying the foundation for long-term stewardship of the natural environment. Each school adopts a different stream, as close to their school as possible. Students learn the basics of watersheds, threats to watershed health, impacts of land use, stream restoration techniques, restoration design, vegetation and water quality monitoring, and native plant identification through on-site hands-on activities and related in-class activities. Students also have opportunities to lead community volunteer watershed restoration events or present the results of their work to professionals in the field. In even a short amount of time, Green Team students can see positive results from their work, while learning how ongoing watershed restoration activities can make a huge impact on wildlife habitat, water quality and the community around their school.

Keywords: Environmental education, Habitat restoration

Susan Barthel[a], Ken Finney[b]

City of Portland - Bureau of Environmental Services, 1120 SW 5th Ave, Suite 1000, Portland, OR 97204
[a]Phone: (503) 823-7268, Email: susanb@bes.ci.portland.or.us
[b]Phone: (503) 823-2367, Email: kenf@bes.ci.portland.or.us

Rocky Butte natural area invasive species control project

In 2008 The City of Portland Revegetation program began an invasive species control project on Rocky Butte's natural areas. The effort is targeted at control of 125 acres of clematis and ivy that threaten the Butte's canopy cover and present a wildfire risk. Rocky Butte's public areas are visited by tens of thousands of visitors and rockclimbers. Worshippers from across the globe come to The Grotto. Portland's Revegetation and Watershed Services teams are working with 6 landowners, rappelling arborists, volunteers and 500+ concerned neighbors and preservationists as they tackle the challenges in this shaded ivy desert.

Keywords: Habitat restoration, Land/watershed management, Plant ecology
Website: www.portlandonline.com/bes

Janet Bebb[a], Mike Wetter[b], Lori Hennings[c]

[a]Phone: (503) 797-1876, Email: Janet.Bebb@oregonmetro.gov
[b]Phone: (503) 797-1538, Email: Mike.Wetter@oregonmetro.gov
[c]Phone: (503) 797-1940, Email: Lori.Hennings@oregonmetro.gov

The Intertwine

Nature is always nearby. Clean air to breathe. Clean water to enjoy. Trails to expore and parks to play in. The wealth of nature at the heart of The Intertwine gives us the promise of having having one of the greatest park, trail and natural area networks in the world. Making The Intertwine world-class is the work of The Intertwine Alliance, a group of non-profits, state and local agencies, businesses and people from across the region working to support The Intertwine by: (1) Investing in new natural area protection and safeguarding waterquality; (2) Funding environmental education to produce the stewards of tomorrow; (3) Expanding our region-wide netowrk of parks, trails and natural areas; and (4) Preserving and restoring fish and wildlife habitat. The Intertwine poster presentation will describe the focus of the The Intertwine and how people can participate and contribute to it's success.

Keywords: Environmental education, Habitat restoration, Transportation
Website: www.theintertwine.org

Leslie Bliss-Ketchum[1a], Catherine de Rivera[1b], Kerry Rappold[2c]

[1]Portland State University - Environmental Science & Management, PO Box 751- ESM, Portland, OR 97207
[2]City of Wilsonville - Natural Resources Program, 29799 SW Town Center Loop E, Wilsonville, OR 97070
[a]Phone: (503) 481-6753, Email: bliss.ketchum@gmail.com
[b]Phone: (503) 725-9798, Email: derivera@pdx.edu
[c]Phone: (503) 570-1570, Email: rappold@ci.wilsonville.or.us

The effectiveness of vertebrate passage and prevention structures: a study of Boeckman road in Wilsonville

Wildlife collisions are a serious issue resulting in costs from property damage, injury and possible death, as well as fatal results for wildlife. In addition, roads fragment habitats and affect the stability and evolution of the surrounding wildlife community. Therefore, it is crucial to examine whether wildlife passage and prevention structures can effectively reduce road mortality while maintaining habitat permeability. Here we examine the effectiveness of the structures of a new (2008) road in the city of Wilsonville, Oregon, the Boeckman Road Extension, which took wildlife passage into great consideration. Our research evaluates the extent to which the species and numbers of animals using the passage structures are representative of the populations in the area and their movements at distance from the road. Motion detect cameras were used to assess large and medium animal movements along five transect parallel to the road. Mark recapture studies were conducted along transects to assess small movements. Data are still being collected and analyzed but preliminary results show no strong difference in overall animal movements among transects. The results will provide information about the community-level effectiveness of different passage structure types and so can help determine what types of passage structures are needed for similar habitats. Future research will include comparison with other roadways and population modeling to determine level of mortality though roadkill that would destabilize populations.

Keywords: Animal ecology, Transportation, Wildlife biology

Judy BlueHorse Skelton

Portland State University - Education, Leadership & Policy, 1935 SE Harold St., Portland, OR 97202
Phone: (503) 234-0266, Email: judybluehorse@comcast.net

Green paths to health: the role of edible and medicinal gardens in the urban landscape

Many factors have contributed to a surge of interest in ecological knowledge systems, from both Native and non-Native communities. Whether the repercussions of unprecedented environmental degradation and the accompanying quality of life issues this raises for all life forms on the planet is the primary factor, or a desire to better care for family health and welfare, communities are discovering the role gardens can play in addressing these concerns. Through re-engagement with the ancient relationships that the plant world offers humans, we reconnect with the natural world surrounding us, even in the city, especially in the city. This presentation highlights the connections between healthy natural eco-systems in urban communities and the creation and integration of edible and medicinal gardens for restoring and maintaining health and healing for all generations.

Keywords: Environmental education

Josh Caplan[1a], Kaitlin Lovell[2], Chip McConnaha[1], Chris Prescott[2b]

[1]ICF Jones & Stokes - Biometrics, 317 SW Alder St, Suite 800, Portland, OR 97204
[2]City of Portland - Bureau of Environmental Services, 1120 SW 5th Ave, Suite 1000, Portland, OR 97204
[a]Phone: (503) 248-9507 x240, Email: jcaplan@jsanet.com
[b]Phone: (503) 823-7089, Email: chrisp@bes.ci.portland.or.us

Status and trends of salmonid potential in Johnson Creek: 2000-2009

Johnson Creek is the largest stream in the Portland metropolitan area and is a key watershed to salmonid recovery efforts. The City of Portland has conducted four large restoration projects in Johnson Creek and improved two obstructions on Kelley Creek in the past 10 years. We quantified the impact of these projects on the watershed's ability to support survival and recovery of three salmonid species listed under the Endangered Species Act: coho, fall Chinook, and winter steelhead. We used the habitat model Ecosystem Diagnosis & Treatment to compare potential fish performance in 2000 (before the restoration projects) and 2009 (after completion of the projects). We found that the City's restoration efforts significantly increased the potential of the stream to support coho and steelhead. The actions improved conditions in specific reaches, thereby increasing their protection value. Other areas, such as middle Kelley Creek, increased in restoration value due to improved access to anadromous fish. Fall Chinook abundance potential did not increase appreciably indicating that the restoration projects did not focus on conditions currently limiting fall Chinook (water temperature and obstructions). Despite significant restoration actions, the stream does not appear to currently support self-sustaining populations of coho, Chinook or steelhead. Our analysis indicates that the availability of habitat, structural diversity, and high temperatures, continue to be major limiting factors in on salmonids in Johnson Creek. Our next steps are to project changes in salmonid potential with climate change, population growth, and additional restoration actions.

Keywords: Fisheries, Habitat restoration, Land/watershed management

John Christy[1a], Angela Kimpo[2b]

[1]Oregon Natural Heritage Information Center - Oregon State University, 1322 SE Morrison St., Portland, OR 97214
[2]Portland Water Bureau, 1120 SW 5th Ave, Portland, OR 97204
[a]Phone: (503) 731-3070 x108, Email: john.christy@oregonstate.edu
[b]Phone: (503) 823-7470, Email: Angela.Kimpo@ci.portland.or.us

Urbanizing flora of Portland, Oregon, 1806-2008

The vascular flora of the Portland-Vancouver area is documented by herbarium specimens and publications dating back to 1806. Urbanization has had predictable effects on the region's vegetation. Native species still outnumber exotics by 16 percent, but today there are about half as many common native species as there were in 1925, and the number of rare native species has increased twelve-fold. Since 1925 the number of common exotics has nearly tripled. The rate of introduction of exotics between 1875 and 1924 averaged between 4.1 and 9.3 species per year, coinciding with rapid growth in population, commerce, and urbanization during that period. The rate of introductions between 1925 and 1999 averaged about 47 new species every 25 years, or an average of 1.9 species per year. Problems posed by the loss of habitat and native species in our area are to some degree counterbalanced by new challenges posed by the arrival and departure of exotic species. Since 1930, the use of water for shipping ballast has reduced the importation of exotic plants, but the growth of the nursery industry has offset this loss by a growing number of exotic ornamental species that have naturalized in our area. Species similar to 128 exotic "waif" species that failed to naturalize prior to 1930 may respond favorably to climate change, giving some indication of future changes in the flora.

Keywords: Conservation biology, Habitat restoration, Plant ecology

Greg Ciannella

Johnson Creek Watershed Council, 1900 SE Milport Rd. , Milwaukie , OR 97222
Phone: (503) 381-7670, Email: greg@jcwc.org

A solution to in-line ponds: Achieving fish passage and habitat restoration

Located along the middle reaches of Kelley Creek, a major tributary to Johnson Creek, the Johnson Creek Watershed Council (JCWC) worked with a private landowner to remove a 6ft. water control structure (dam). The dam itself was a barrier to fish passage, and it backed up Kelley Creek to form a 200ft. long and 80ft. wide pond that served as a heat and bacteria source to the creek. The objectives of this project were to remove the dam, build a natural channel that gains 10ft. in elevation over 500ft. of channel length, construct an earth berm to retain pond off-line, and improve habitat value and water quality. The ecological benefit this project provides includes fish passage and full access upstream, added in-stream habitat value, improved water quality conditions, and a native vegetated floodplain. Construction was in the summer of 2007. Contractors removed the small dam, built a 500ft. long channel with boulder/cobble riffles and associated pools, installed 12 pieces of woody debris, and built an earth berm to separate the channel from the retained pond feature. Post construction, the site was seeded with a native riparian mix, and revegetated with native trees and shrubs. This project was designed by Tetra Tech and built by Henderson Land Services. Funding was provided by OWEB, East Multnomah SWCD, The Nature Conservancy, and City of Portland. This project was not only implemented for its ecological benefits, but to also serve as a demonstration for a solution to problems associated with in-line ponds along creeks.

Keywords: Fisheries, Habitat restoration, Water quality
Website: www.jcwc.org/kelleycreek.htm

Mary Coolidge

Audubon Society of Portland - Conservation, 5151 NW Cornell Road, Portland , OR 97210
Phone: (503) 292-6855 x111, Email: mcoolidge@audubonportland.org

BirdSafe Portland: Assessing the magnitude of bird window strikes in the city of Portland, September 2009

An estimated 100 million to 1 billion bird deaths occur worldwide annually as a result of window strikes, a mortality rate second only to habitat destruction. Numerous cities have documented large numbers of both daytime and nighttime collisions with windows on glassy buildings. No study has ever measured the magnitude of this occurrence in Portland, and our urban landscape is undergoing rapid changes, with new architecture trending toward taller, glassier structures. An increasing body of research has begun to identify building designs that reduce incidence of bird collisions, and experts suggest incorporation of these designs into LEED certification standards. Portland is poised to join a growing list of cities that require implementation of wildlife friendly building design in the planning process. Lights Out campaigns (underway in San Francisco, Boston, Toronto, Tallahassee, Minneapolis, and Chicago) can reduce nighttime bird mortality, reduce ecological light pollution, improve stargazing conditions, and increase energy savings. With an Oregon Zoo Future for Wildlife grant, we conducted dawn surveys around nearly 50 buildings and 4 skybridges throughout September. Preliminary results suggest that some false-negative data was produced as a result of pervasive obstacles. These included predawn maintenance crews, as well as physical catchments created by eccentric rooflines, terraces, and private plazas, none of which were accessible via public right-of-way transects. Outreach to building managers began in mid-September, resulting in late-stage cooperation with maintenance personnel and increased roofline and private area access, but increased cooperation with building managers will be necessary to ensure comprehensive data collection in the future.

Keywords: Conservation biology, Environmental policy, Wildlife biology
Website: www.audubonportland.org

Daniel Covington[1a], Patti Caswell[2b], Bob Carson[1c]

[1]Mason, Bruce & Girard, Inc., 707 SW Washington, Suite 1300, Portland, OR 97205
[2]The Oregon Department of Transportation - Geo-Environmental Section, 355 Capitol Street NE, Suite 301, Salem, OR 97301
[a]Phone: (503) 224-3445, Email: dcovington@masonbruce.com,
[b]Phone: (503) 986-4335, Email: patti.caswell@odot.state.or.us
[c]Phone: (503) 224-3445, Email: bcarson@masonbruce.com

ODOT's riparian and wetland mitigation legacy: a strategic learning opportunity

The Oregon Department of Transportation (ODOT) constructs projects to ensure a safe and efficient transportation infrastructure. Typically, projects consist of road improvements, new road construction, bridge upgrades, bridge replacements, and new bridge construction. Although avoiding and minimizing impacts to natural resources are integral to ODOT's design considerations, some projects result in impacts to jurisdictional waters of the U.S. and State. Pursuant to environmental permit requirements, ODOT implements mitigation for a wide range of impacts. The overall mitigation goal is to replace the wetland or waters functions that are lost or impaired due to project construction. In the spring of 2009, the ODOT Wetlands Program pursued a strategic learning opportunity by evaluating the post-monitoring period conditions of 29 "legacy" mitigation sites ranging from 8 to 17 years since mitigation construction. ODOT retained the services of Mason, Bruce & Girard (MB&G) to perform the evaluations using a site assessment methodology developed by the Wetlands Program. The purpose was to assess contemporary vegetation communities and visible indicators of hydrology in terms of mitigation acreage, target vegetation communities, and other permit requirements. Biologists documented wetland boundaries, wetland classes (Cowardin and HGM methods), native plant species, abundance and distribution of noxious weeds, propagule collection opportunities, site hydrology, and impacts of human disturbance. Field results indicated that existing conditions and continued achievement of mitigation objectives were variable depending on construction methods, original planting schedule, human disturbance, as well as mitigation site hydrology and soil characteristics. Finally, MB&G identified potential lessons-learned for future mitigation.

Keywords: Environmental policy, Habitat restoration, Transportation

Kristin Day

Landscape Architecture, 7200 N Concord Ave, Portland, OR 97217
Phone: (971) 275-2555, Email: krisdayo@gmail.com

Collaborative prospects: school landscapes as catalysts for urban sustainability

This project seeks to create a vision for an expanded green infrastructure system in Portland, Oregon, propelled by the systemic development of urban green infrastructure elements on school grounds. It explores the hypothesis that *school landscapes are uniquely positioned to function collectively as a network of designed spaces* toward the goals of contributing spatially and functionally to the physical and social infrastructure systems of urban and urbanizing communities. As pervasive and socially valued nodes within communities, school landscapes possess special status as public land holdings; through the systemic development of onsite stormwater management features, habitat gardens, and other functional landscape components, they are capable of augmenting the city's overall green infrastructure system, while increasing opportunities for experiential education based in the context of Portland's unique urban ecology. My project spatially assesses the collaborative potential and connectivity value of this mode of development through the analysis of several series of original maps that illustrate currently identified interests of numerous stakeholders. The outcomes generated show areas where multiple public agendas my be simultaneously attended to through collaborative work, possibly in more meaningful ways than may have been feasible otherwise. This work may be useful in helping to envision an organized program for the expansion of the city's green infrastructure agenda on Portland's school grounds and in identifying development partnerships toward this end. It may also provide a useful framework for assessing the collaborative potential for similar programs elsewhere.

Keywords: Environmental education, Land use planning, Sustainable development

Brian Fletcher[1a], Torrey Lindbo[2b]

[1]Portland State University - Environmental Science & Management, PO Box 751- ESM, Portland, OR 97207
[2]City of Gresham - Environmental Services, 1333 NW Eastman Pkwy, Gresham, OR 97030
[a]Email: Brian C Fletcher [briancfletcher@gmail.com]
[b]Phone: (503) 618-2405, Email: Torrey.Lindbo@GreshamOregon.gov

Downspout disconnection suitability and incentive analysis for the City of Gresham, Oregon

The City of Gresham is investigating residential downspout disconnection as a means for reducing residential stormwater currently entering the municipal separate storm sewer system (MS4). The City of Portland has been implementing a similar program in combined sewage areas, but Gresham is exploring this method for stormwater volume reduction in an MS4 area. To determine whether downspout disconnection would be a cost-effective way to help the city reduce stormwater volumes entering local streams, 1) the city conducted a pilot project in a neighborhood monitored for discharge before and after disconnections, 2) a PSU graduate student assessed soils city-wide to determine suitability for infiltration, and 3) a survey was mailed to 500 random residences within the area of the city deemed to be highly suitable for infiltration. The initial map used NRCS soil data and slopes to determine low, medium and high suitability zones. The suitability map was validated by determining the soil textural classes at 55 random residences throughout Gresham, with the results agreeing with 73% of the published NRCS soil textural classes. Survey responses reveal that about 25% of homeowners are already willing to disconnect with little incentive, 25% are unwilling and think their soils are not suitable for infiltration, and the majority of homeowners want some level of incentive that ranges from parts and labor to receiving stormwater fee discounts to receiving a one-time payment. The willingness and incentive data is currently being evaluated to calculate a total cost estimate and potential stormwater volume reduction for the city.

Keywords: Environmental policy, Land/watershed management, Soil science
Website: www.greshamoregon.gov/watershed

Corie Harlan

Metro - Nature in Neighborhoods, 600 NE Grand Ave., Portland OR 97232
Phone: (503) 797-1764, Email: corie.harlan@oregonmetro.gov

Nature in Neighborhoods: Integrating Habitats – What's new? What's next?

In 2008, Nature in Neighborhoods' Integrating Habitats design competition called for innovative, visionary development practices that balanced design excellence, ecological stewardship and economic enterprise. Winning designs selected by the world-renowned jury redefined the current language and standards of environmental sustainability by fostering balance between conservation and development, maximizing biodiversity and safeguarding water quality for this generation and those to come. Integrating Habitats created a ripple effect of influence, interest and action around nature-friendly design ideas that has inspired a region-wide movement – one that places habitat protection and restoration within our region's most important development goals and creates healthier homes for people, fish and wildlife. In an effort to sustain this movement and momentum and help catalyze on-the-ground nature-friendly development approaches as directed by the Metro Council, collaborative projects with jurisdictions, students, design professionals, political leaders, developers and advocacy groups has continued and grown. Highlights include a riverfront redevelopment studio, a collaborative Transit-Oriented Development and Nature in Neighborhoods studio based in Gresham, and two featured case studies about a developer and community activist inspired by the project. Learn more about what's new and what's next for Integrating Habitats.

Keywords: Environmental education, Land/watershed management, Sustainable development
Website: www.oregonmetro.gov/integratinghabitats

Ted Hart

Portland State University - Environmental Science & Management, PO Box 751- ESM, Portland, OR 97207
Phone: (541) 760-9389, Email: hartt@lanecc.edu

Do different plant species and root structures increase infiltration rates in urban bioswales?

This study will examine whether bioswale vegetation with larger taproots increases infiltration rates and hydraulic conductivity compared to vegetation with small fibrous root systems in Portland, Oregon. Species and root structure differences in infiltration rates have been suggested in bioswales but not shown, and an increasing number of urban bioswales are being installed, particularly in Portland, with the primary purpose of water conveyance. Three species will be used: Vine Maple (*Acer circinatum*), Kelsey Dogwood (*Cornus sericea 'Kelseyi'*), and Spreading rush (*Juncus patens*) which represent a continuum from larger taproots to finer fibrous roots. Two year old seedlings will be repotted into ten gallon containers filled with two feet of soil (18 in of topsoil and six in of clay) representative of current Portland bioswale particle size and distribution and compaction. A randomized block design will include four treatments (three species and no-tree) and eight replicates (32 containers). Infiltration rate (ml/s) and hydraulic conductivity will be calculated twice a month for one year. Above ground, topsoil root, and clay root biomass will determined at the end of the study. I expect to see a correlation between root biomass in the topsoil and clay and infiltration rate and hydraulic conductivity, with larger taproot species having higher infiltration rates and higher conductivity compared to the finer fibrous root species (Vine maple, Kelsey dogwood, Spreading rush).

Keywords: Land use planning, Plant ecology, Sustainable development

Kate Holleran[a], Jeff Merrill[b]

Metro - Science and Stewardship, 600 NE Grand Ave, Portland, Or 97055
[a]Phone: (971) 235-7157, Email: kate.holleran@oregonmetro.gov
[b]Phone: (503) 702-2050, Email: jeff.merrill@oregonmetro.gov

Lessons learned in the acquisition and stabilization of new natural areas

In 2006, the Metro district voters passed a $227 million dollar bond measure that focuses on the protection of water quality and wildlife habitat. Over 1000 acres have been acquired in 27 target areas across the district from Forest Grove to Gresham. The willing seller natural areas acquisition program acquires properties based on target area specific goals and new properties are immediately stabilized to reduce or mitigate any threats to the natural resources and public safety on the property. After three years of property acquisition and stabilization, Metro staff has identified a set of best practices for rapid stabilization of new properties that have application across ownership, regardless of the size. The lessons learned from the past three years of property acquisition and the best practices for property stabilization will be presented, using specific examples. Key best practices include: survey of existing conditions, identification of threats, communication with neighbors, boundary identification and marking, garbage removal, immediate initiation of weed control, and aggressive site prep and revegetation.

Keywords: Conservation biology, Habitat restoration, Water quality
Website: www.oregonmetro.gov

Lily House-Peters[a], Heejun Chang[b]

Portland State University - Geography, 1721 SW Broadway, Portland, OR 97201
[a]Phone: (870) 821-0595, Email: lilleehp@gmail.com
[b]Phone: (503) 725-3162, Email: changh@pdx.edu

Impacts of urban design and vegetation characteristics on the surface energy budget in Hillsboro, Oregon

Urban landscapes have significantly different microclimates than rural or suburban areas. The process of urbanization produces radical changes in the nature of the surface and atmospheric properties of an area. Urban construction materials, impervious surfaces, and lack of vegetation cause the system to more effectively store heat, while simultaneously reducing the rate of net long-wave cooling from surfaces near buildings. This urban heating could result in higher water consumption by increasing the need for irrigation. This research aims to elucidate the surface energy balance at the census block scale in Hillsboro, Oregon, in order to examine the effect of building materials, building density and type, and amount of vegetation on urban boundary climate heating and cooling rates. We use the Local-Scale Urban Meteorological Parameterization Scheme (LUMPS) to model the amount of energy partitioned into latent and sensible heat flux at an hourly scale to examine the rates of heating and cooling and compare that with water consumption in each census block. Using spatial quantitative analysis techniques we examine the relationship among water use, socio-economic characteristics, and surface energy balances for each census block. Finally, we perform a sensitivity analysis, altering the vegetation, building material and urban density characteristics to quantify the influence of each of these parameters on the urban heating and water consumption in the study area. Our research findings can assist urban planners and water resource managers in future decisions regarding land use change, building materials used and recommended, and urban vegetation enhancement.

Keywords: Land use planning, Land/watershed management, Sustainable development

Billy Johnson[a], Zach Diehl[b]

City of Salem - Stormwater Services, 1410 20th Street SE, Salem, OR 97302
[a]Phone: (503) 588-6063 x7810, Email: bijohnson@cityofsalem.net
[b]Phone: (503) 588-6063 x7719, Email: zdiehl@cityofsalem.net

Urban watershed management: City of Salem's Stream Cleaning program

Urban development often confines natural waterways and increases flow via surface water runoff. Alleviating the increased threat of flooding without impacting natural stream processes within the watershed can pose a significant challenge. The City of Salem seeks to balance these seemingly conflicting issues by implementing the Annual Stream Cleaning Program. Each summer, the City hires college students with an educational background in natural resources to walk over 50 miles of urban waterways, removing invasive vegetation and trash. The students' knowledge of natural resources allows consideration of natural processes and habitat needs when removing debris and restoring conveyance. Community outreach is also a priority for the program. Each year, the crew participates in a variety of restoration projects in collaboration with local residents and schools. Crew members are able to utilize their education and knowledge to offer advice on issues such as native plantings and erosion control. Throughout the season, the crew's efforts focus on key principles like interception, infiltration, and dissipation. The Stream Cleaning Crew is a unique and innovative program which strikes a successful balance between maintaining conveyance and reducing the risk of flood damage, while also enhancing natural habitat.

Keywords: Environmental education, Habitat restoration, Water quality
Website: www.cityofsalem.net/Departments/PublicWorks/Operations/StormwaterServices/Pages/StreamCleaning.aspx

Jennifer Karps

City of Portland - Bureau of Environmental Services, 1120 SW 5th Ave, Suite 1000, Portland, OR 97204
Phone: (503) 823-2263, Email: jennifer.karps@bes.ci.portland.or.us

Planting trees for clean rivers: The Grey-to-Green urban canopy effort

Every tree planted in Portland contributes to a cleaner Willamette River. This recognition that trees and other green infrastructure provide significant environmental benefit through ecosystem services underlies the Grey-to-Green initiative: a five-year, $50 million investment in green solutions to help manage stormwater and improve watershed health. The urban canopy effort aims to plant 83,000 trees in Portland over the five-year period. Current tree planting mechanisms include partnerships with nonprofit Friends of Trees and Portland Parks' City Nature in addition to the nascent Treebate program. Halfway through year two, this update provides a brief synopsis of tree planting challenges, successes, and strategies.

Keywords: Land/watershed management, Sustainable development, Water quality
Website: www.portlandonline.com/bes/greytogreen www.portlandonline.com/bes/trees

Christine Kendrick[1a], Adam Moore[2b], Miguel Andres Figliozzi[2], Linda George[1c], Ashley Haire[2], Chris Monsere[2]

[1]Portland State University - Environmental Science & Management, PO Box 751- ESM, Portland, OR 97207
[2]Portland State University - Civil and Environmental Engineering, PO Box 751- CEE, Portland, OR 97207
[a]Phone: (240) 731-8195, Email: kendrick.christine@gmail.com
[b]Email: adam.moore@pdx.edu
[c]Phone: (503) 725-3861, Email: georgel@pdx.edu

Investigation of traffic dynamics, mode of travel and urban form on human exposure to air pollutants in transportation microenvironments

Traffic-related pollutants can affect urban ecological systems by perturbing biogeochemical cycling, aggravating the urban heat island effect and contributing to toxic uptake in urban fauna and flora. Humans dwelling in urban cores are regularly exposed to heightened levels of vehicle-based pollutants through various routes of exposure. Urban areas also offer opportunities such as greater multi-modal travel to reduce vehicle use and enhance public health through active living. Some of these modes of travel, such as bicycle commuting along traffic corridors, may reduce overall vehicle emissions but could increase an individual bicyclist's exposure to harmful pollutants. In order to understand and minimize such exposure to heightened concentrations of traffic-related pollutants in urban transportation microenvironments, pollutant levels need to be characterized according to traffic dynamics, meteorological variables, type of roadway, and surrounding urban infrastructure. The research presented here illustrates the initial work accomplished in an on-going project which measures real-time pollutant exposure of pedestrians, cyclists, and residents in several high-volume corridors in the Portland metropolitan area and correlates these pollutant levels with simultaneous micro-level traffic characteristics, including vehicle mix, speeds, congestion, and acceleration. The goal of the project is to determine the relationships between traffic stream characteristics and pollutant levels, and to make policy recommendations through possible guidelines concerning intersection and bicycle infrastructure design along with traffic management protocols to mediate and reduce the harmful effects of these environmental contaminants on urban dwellers and the larger environment.

Keywords: Air quality, Sustainable development, Transportation

David Kennedy

Portland State University - Environmental Science & Management, PO Box 751- ESM, Portland, OR 97207
Phone: (503) 724-4232, Email: p3artr33@gmail.com

A sample of native freshwater mussels on the Middle and Upper Columbia Slough in Portland, Oregon

The purpose of this Masters of Environmental Management project is to examine the basic parameters of the native freshwater mussel species (genus Anodonta) in the Upper and Middle Columbia Slough in Portland, Oregon. This evaluation will include a species list, an assessment of age characteristics of the sampled population, and provide some localized population quantities. An effort was made to determine the effectiveness of two different survey methods. The City of Portland's Bureau of Environmental Services (BES) will use the data gathered in this project to guide future sampling efforts. A sample of 25 points were randomly selected from the centerline of the Columbia Slough channel by a sampling process known as the General Randomized Tessellation Stratified (GRTS) method. These points were used to delineate search areas that were surveyed with a visual search and benthic sampling method. The visual survey noted live, dead, and mussel middens found on the channel edge. Mussels removed during the benthic sampling were measured and identified by species and clade. Due to unique physical conditions found in the slough, a specialized sampling method and tool were created for the benthic sampling. The survey found three species (two clades) of the genus Anodonta with a bimodal distribution of age across all of the sample sites. The density of freshwater mussels in the sample is 0.6 mussels/m^2 with a range from 0.2 to 0.9 mussels/m^2 depending on spatial groupings. The use of visual survey results to determine sites for further study was found to be beneficial.

Keywords: Animal ecology, Water quality, Wildlife biology
Website: www.fws.gov/columbiariver/mwg/communications.htm

Clair Klock

Clackamas Soil and Water Conservation District - Rural and Community Conservation, 221 Molalla Ave, Suite 105, Oregon City, OR 97045
Phone: (504) 655-3144 x105, Email: clair.klock@or.nacdnet.net

Charging our urban groundwater

Let's imagine that the Metro area could recharge all the groundwater it had prior to European settlement times. How would we go about it? We would use the latest science of the day. For the past 2 decades we have used stormwater retention ponds, and Bioswales, which seemed the best and brightest ideas. Now we are trying to use raingardens to infiltrate even more water into the ground on the site where it falls. What is the next big idea? Let's talk about using rainwater harvesting systems in conjunction with raingardens to achieve maximum recharge of the urban aquifers on a systematic basis.

Keywords: Hydrology, Land/watershed management, Sustainable development

Rachel Kutschera

Portland State University - Environmental Science & Management, PO Box 751- ESM, Portland, OR 97207
Phone: (503) 752-5098, Email: rkutsche@pdx.edu

Turtle conservation in an urban environment via habitat assessment

The Western Pond Turtle (*Actinemys marmorata marmorata*) and Western Painted Turtle (*Chrysemys picta bellii*), both designated "critical" on the Oregon state Sensitive Species List, are threatened by habitat loss and degradation, especially in urban environments where there are increased threats to their survival. This project addressed conservation issues surrounding native turtles in the Portland, Oregon area in two ways. A methodology to evaluate the presence of turtle habitat was developed after extensive literature review and consultation with regional habitat managers. The methodology was then tested on 43 public and privately owned sites within and adjacent to the urban growth boundary (UGB) to critique its usability and determine if turtle habitat is still intact within the UGB. Tested sites were those listed in a database compiled by Metro, Portland's regional government, of turtle sightings reported to various agencies within the past 40 years. The methodology proved to be useful when paired with an aerial photograph of each site. It can be utilized in a variety of landscapes and regions, and implemented with minimal equipment by both citizen science volunteers and professional habitat managers. Assessing sites where turtles were historically sighted revealed many degraded or now unusable areas for turtles. However, several locations exist where turtles are living or could potentially thrive with little or no habitat modification. Results will be used by Metro to prioritize areas for turtle habitat conservation and identify potential partnerships with site owners in an effort to meet regional biodiversity conservation goals.

Keywords: Conservation biology, Land/watershed management
Website: www.oregonturtles.com/

Jim Labbe[1a], Denisse Fisher[2b]

[1]Audubon Society of Portland - Conservation, 5151 NW Cornell Road, Portland , OR 97210
[2]Portland State University - Environmental Science & Management, PO Box 751- ESM, Portland, OR 97207
[a]Phone: (503) 292-6855, Email: jlabbe@urbanfauna.org
[b]Phone: (520) 272-5464, Email: fisherda@gmail.com

Phase II of regional urban forestry assessment and evaluation for the Portland-Vancouver region

In the second phase of our assessment, we documented differences in local policies and programs that aim to preserve, plant, and manage to trees on private land and in the public right-of-way. Findings show that urban forestry policies vary in applicability, strength, and enforcement of regulations; the extent of voluntary programs for tree preservation and planting; funding; and the level of citizen involvement. The size of regulated trees, whether development is proposed, zoning, and level of staff training all appear to directly influence whether trees are subject to preservation, protection, removal, or mitigation. Permit exemptions, limited spatial extent of regulations, and/or the absence of protection outside the development review process reduce the applicability and effectiveness of tree preservation and mitigation standards in several municipal or development codes. While twenty-five out of the thirty jurisdictions have some sort of ordinance regulating tree removal on private land outside environmentally sensitive areas, only seven of those twenty-five jurisdictions apply regulations consistently across all land-uses categories. Street tree policies vary less in the region. However variations exist in the extent of education, incentive, and maintenance programs; in local inventories; and financing. This diversity in urban forestry programs provides the opportunity to share successes and shortcomings toward increasing the effectiveness of efforts to preserve, improve, and expand the region's urban forest. This project begins that process by generating and sharing a consistent body of information. The results of this project, other research, and consistent information on changes in population, development, and forest canopy cover could provide the basis for further evaluating and improving local policies and programs.

Keywords: Environmental policy, Land/watershed management

Ted Labbe[a], Maren Murphy[b]

DEPAVE - CityRepair, PO Box 42615, Portland, OR 97242
[a]Phone: (503) 758-9562, Email: ted.labbe@gmail.com
[b]Phone: (509) 991-0762, Email: depavermaren@gmail.com

Project DEPAVE: Community re-greening in action!

DEPAVE, a project of Portland's CityRepair, leads a citizen-driven effort to remove unnecessary pavement, re-green our neighborhoods, reduce stormwater runoff, create community, and restore habitat for people and wildlife. DEPAVE began in 2007 when several friends helped each other tear out pavement in their backyards. In June 2008 we launched our first community DEPAVE event at Fargo Garden in North Portland, engaging over 200 volunteers to transform a 3,000 sq ft private parking lot into an evolving perennial food forest garden. In 2009, we completed six new DEPAVEs removing over 30,000 sq ft of underutilized pavement at: a church, two schools, a homeless shelter, an affordable cohousing community, and a private architecture firm. DEPAVE actively seeks out projects in underserved neighborhoods, collaborating with a diverse array of public and private organizations. Our team combines the vision of artists, designers, scientists, engineers, contractors, educators, planners, policy-makers, and far-sighted property owners. DEPAVE has developed a progressive model of community engagement in watershed restoration and urban re-greening, through events, publication of a how-to manual, educational outreach, and advocacy. DEPAVE is driven by an infectious, scruffy, do-it-yourself energy to transform and regreen our urban common space. We will profile our projects and ongoing monitoring, discuss lessons learned, and highlight barriers and challenges to the DEPAVE mission to liberate our soil!

Keywords: Environmental education, Habitat restoration, Sustainable development
Website: www.depave.org

Ashby Leavell[a], Amber Ayers[b]

Metro Native Plant Center, 600 NE Grand Ave, Portland, OR 97232
[a]Phone: (434) 989-3461, Email: ashbyleavell@gmail.com
[b]Phone: (541) 292-9992, Email: amber.n.ayers@gmail.com

Tracking the phenological developments of native wildflowers at Cooper Mountain Nature Park

This project examines the developmental changes occurring in wildflowers at Cooper Mountain Nature Park. The goal is to successfully implement a program to monitor and collect rare wild flowers for the Metro Native Plant Center. The project began as our Americorps Community Action Project, CAP, through NWSA. Our “Bloomtime Project” aids in the Native Plant Center’s vital seed saving and amplification process by tracking the phenological developments for native flowers at Cooper Mountain. We tracked changes in phenological events involving plant flowering; with observations of interest ranging from first bud, flowering, seed formation, to seed dispersal. We created a straightforward data collection formula with codes assigned to each species, site, and phenological state. Cooper Mountain is a unique habitat with Oregon White Oak savannas and open prairies that have been relatively undisturbed for hundreds of years. This distinctive area is home to diverse and rare native wildflowers that have all but disappeared from the Northern Willamette Valley. Over three months we surveyed the phenological changes of targeted wildflower species on the mountain each week. Working with Metro staff, we set up a GPS database, took hundreds of valuable photographs of the flowers in each phenological stage, and successfully collected ripe seed from many significant species. This information reveals when and where the ideal time for seed collection is to local resource technicians, biologists and volunteers. With future years of data collection, we can examine irregularities in species bloom times resulting from changes in our local climate.

Keywords: Conservation biology, Habitat restoration, Plant ecology

Karl Lee

U.S. Geological Survey - Oregon Water Science Center, 2130 SW 5th Ave, Portland, OR 97201
Phone: (503) 251-3252, Email: kklee@usgs.gov

Hydrologic analyses supporting assessment of land-use changes in the Johnson Creek basin, in the Portland Oregon metropolitan area

As the population of the Portland (Oregon) metropolitan area increases, pressure to convert agricultural and low-density urban land uses to dense urban development continues. Understanding is needed on the processes that affect water quality of Johnson Creek, and changes in water quality that may result from changes in land use in the basin. The upper part of the Johnson Creek basin is an area of relatively erodible soils and minimal groundwater discharge to the stream, suggesting the stream in that area is particularly susceptible to entrainment of sediment during the high-flow season, and warm summertime stream temperature. Suspended-sediment concentration at sites midbasin and at the mouth of Johnson Creek was estimated based on the relation of hourly turbidity data and discrete suspended-sediment samples. Sediment load during a 3-day flood accounted for half the annual sediment load, and sediment load from the upper basin was large relative to drainage basin size. Sources of stream warming during the low-flow season were explored by continuous records of stream temperature and discrete streamflow measurements. Areas of groundwater discharge to the creek were identified both by decreases in stream temperature and by increases in streamflow from one location to the next location downstream. Regulatory goals call for a several degree Celsius decrease in summer stream temperature. Hourly stream-temperature data indicate warming from an in-line pond caused a similar-magnitude increase in stream temperature. Mitigation of stream warming may be achieved by reconfiguring ponds, enhancing riparian vegetation, and maximizing groundwater discharge to the stream.

Keywords: Hydrology, Land/watershed management, Water quality
Website: http://or.water.usgs.gov/johnsoncreek

Andrea Melnychenko

Portland State University - Biology, PO Box 751 , Portland, OR 97207
Phone: (971) 506-6796, Email: andreamelny@comcast.net

Understanding the relationship between ornamental plants and air quality in urban ecosystems: A study of isoprene emission in bamboo

The urban greening movement is gaining momentum in cities like Portland, with bamboos playing an ever-increasing number of roles in landscape, horticulture, and urban screening. Beyond preliminary surveys, little had been done to characterize biogenic volatile organic compound (BVOC) emission within the tribe Bambuseae. BVOC emissions from plants are critical and often overlooked aspects of air quality in urban ecosystems. Isoprene is the most abundant non-methane BVOC, and in the presence of anthropogenic pollution, such as NO_x, BVOCs can lead to the formation of tropospheric ozone and seed the formation of secondary aerosol particles that lead to SMOG. Here we present results of the most extensive characterization to date of isoprene emission from 25 genera, 82 species, and 108 varieties of ornamental bamboo. Surprisingly, we found a high degree of variability in isoprene emission rates across genera and among species within genera, which is rarely the case with BVOC emitting plants. In general, fast-growing monopodial (running) genera such as Phyllostachys, which includes the horticultural varieties black bamboo and golden bamboo, were found to emit significant quantities of isoprene, while sympodial (clumping) bamboos emit relatively small amounts of this volatile hydrocarbon. Selecting low BVOC emitting bamboo cultivars may help to prevent unintended negative consequences on urban air quality.

Keywords: Air quality, Plant ecology

David Moen

Oregon Zoo - Conservation, 4001 SW Canyon Road, Portland , OR 97220
Phone: (503) 954-4772, Email: columbiacondor@gmail.com

Analysis of bio-cultural context of former California condor population in the Pacific Northwest: Collaborative interdisciplinary research methods

The California condor (*Gymnogyps californianus*) was once found along the Pacific Coast from British Columbia to Baja California (Wilbur 1973). Until the early 1900's this conspicuous bird was a thriving member of Pacific Northwest communities. As a result of its absence, a substantial gap exists in understanding the condor's ecological and cultural roles in its northern home range. While the Oregon Zoo now breeds condors in captivity, it is only recently that scientists have made real efforts to expand on the limited information known about this former population. This paper summarizes a preliminary attempt to bridge this gap through traditional ecological knowledge (TEK) inquiry to ascertain how indigenous knowledge systems contribute to condor restoration for ecological and cultural renewal. Although direct evidence of former nest sites in Oregon and Washington has yet to be obtained; cultural, historical and archaeological evidence suggests condors were a resident breeding species here. Beginning in 2006 this information promoted the first nesting habitat surveys in the region. Surveys have focused on the Columbia River Gorge and high rock outcroppings along its tributaries. Soil samples obtained from cliff caves are now being analyzed for condor DNA to establish the condor's historic breeding range. This effort represents a beginning point for condor conservation based a more holistic and inclusive framework. The interdisciplinary nature of this study highlights how participatory place-based research contributes to the co-creation of knowledge and emphasizes how restoration of a shared ecology via species recovery promotes cross-cultural collaboration in both rural and urban contexts.

Keywords: Animal ecology, Conservation biology, Environmental education
Website: www.oregonzoo.org/Condors

Dawn Nilson

AMEC Earth & Environmental, 7376 SW Durham Ave, Portland, OR 97224
Phone: (503) 639-3400, Email: dawn.nilson@amec.com

Shedding light on an urban ecology menace: light pollution

An environmental health magazine recently reported, "Many environmentalists, naturalists, and medical researchers consider light pollution to be one of the fastest growing and most pervasive forms of environmental pollution." Light pollution comes in many forms, including sky glow, light trespass, glare, and overillumination. Simply put, light pollution is excessive and inappropriate artificial light. Light pollution has been shown to adversely affect vegetation and wildlife, particularly trees, fish, bats, raccoons, coyotes, deer, turtles, frogs, and birds. Disruption of the human circadian clock from light pollution is linked to several medical disorders, including depression, insomnia, cardiovascular disease, and cancer. The ecological concerns of light pollution extend to the wasteful use of energy resources in a time of global climate change. Finally, light pollution interferes with an ages-old tradition of observing "the continuous and uniform course of the heavenly bodies." The International Dark-Sky Association (IDA) has been an active leader in public education and working with stakeholders to develop a uniform model ordinance to address light pollution. There are numerous remedies to choose from, we just need the will to act. Oregon and the Portland Metro area have a national reputation for fostering sustainability, yet as a community we have done little to address this serious menace to our urban ecosystem.

Keywords: Environmental education, Sustainable development, Wildlife biology

Jason O'Brien

Oregon Master Naturalist Program - Oregon State University Forestry & Natural Resources Extension, 237 Peavy Hall, Corvallis, OR 97331
Phone: (541) 737-3856, Email: jason.obrien@oregonstate.edu

Introducing the new Oregon Master Naturalist program

Soon Metro residents will have an opportunity to learn about and explore Oregon's diverse natural resources. Oregon State University Forestry and Natural Resources Extension, along with various stakeholders, is currently developing an adult service-learning program called *Master Naturalist*. Similar to Master Gardener, this program will include 40+ hours of hands-on coursework. Specific topics will include: biogeography, ecosystems, geology, climate, ecological principles, plant and animal biodiversity, human history and impacts, management principles and techniques, science literacy, plus three service options; communication, citizen science and stewardship. Upon completion, participants will have an opportunity to give back through service to their communities. While still early in its development, Oregon Master Naturalist is likely to give citizens from other parts of the state firsthand experiences in unique natural areas through hands-on regional Master Naturalist "schools". In the Portland/Vancouver metro area, the result is a cadre of dedicated, passionate and well-educated citizens that are available to the various educational institutions, state and federal agencies, local governments, non-profit organizations and businesses to engage the public and benefit natural resources. Other states have successful Master Naturalist programs and have seen positive social and environmental impacts, not to mention thousands of hours of volunteerism equivalent to thousands of dollars in cost savings. As a state rich in natural resources and a citizenry that is willing to contribute to and treasures this heritage, Oregon appears ready for such a program. In this session, you will learn about how the program is being developed and how you can become involved.

Keywords: Environmental education, Environmental social sciences, Habitat restoration
Website: http://www.oregonmasternaturalist.org

Portland Bureau of Environmental Services, Erica Timm[a]

City of Portland - Bureau of Environmental Services, 1120 SW 5th Ave, Suite 1000, Portland, OR 97204
[a]Phone: (503) 823-5729, Email: erica.timm@bes.ci.portland.or.us

Landscapes for Rain: The art of stormwater

The City of Portland's Bureau of Environmental Services is actively involved in engaging the community, private property owners, architects, engineers, and developers in implementing on-site surface stormwater management techniques that mimic natural conditions by allowing rain to filter through vegetation and soil and soak into the ground. This reduces the quantity and improves the quality of stormwater flowing from development to rivers and streams. This approach recognizes stormwater as a resource to be integrated into site planning and architectural development. Through "Landscapes for Rain: The Art of Stormwater," Environmental Services combines its commitment to clean rivers and streams with an appreciation of the arts. The photography exhibit showcases stormwater as a resource and illustrates opportunities to integrate stormwater management with art, landscaping and architecture in creative ways that capture the imagination, enhance property values and create community amenities. The Tabor to the River program, a capital improvement project in southeast Portland integrating hundreds of sewer, green stormwater management, tree planting and other watershed projects, incorporates the photography exhibit into its community education and engagement efforts. The exhibit is displayed in local businesses, organizations and at community events within the program area in Southeast Portland aiming to educate community members and inspire them to take similar actions in their neighborhood. Tabor to the River is a partnership between the city and the community to naturally manage stormwater and enhance watershed health; Landscapes for Rain: The Art of Stormwater helps to build and foster partnerships with the community.

Keywords: Environmental education
Website: http://www.portlandonline.com/sustainablestormwater or http://www.portlandonline.com/bes/tabortoriver

Chris Prescott

City of Portland - Bureau of Environmental Services, 1120 SW 5th Ave, Suite 1000, Portland, OR 97204
Phone: (503) 823-7089, Email: chrisp@bes.ci.portland.or.us

Effect of urban land use on macroinvertebrate community composition in Tryon and Fanno creeks

From 2006-2008, the City of Portland conducted a pilot macroinvertebrate monitoring program in Tryon and Fanno creeks. The study used a probabilistic sampling approach consistent with statewide DEQ methodology. Fifty stations were sampled through the two watersheds over three years, with additional habitat and water quality data collected at each sampling site. Composition of the insect community was characteristic of degraded urban streams. Diptera and oligochaetes were the most common taxa. Mayflies and caddisflies were commonly present, but were represented by only a few tolerant taxa within these orders. Stoneflies were very rarely observed. While the communities scored very poorly in comparison to western Oregon reference streams, there were clear differences in quality amongst the subwatersheds of the study area. Tryon Creek communities were among the best and worst observed; Arnold Creek, Nettle Creek and the State Natural Area had higher community metrics, while the urbanized upper watershed above and below I-5 were the most degraded. Fanno subwatersheds were intermediate to these two areas. The composition of the macroinvertebrate communities was correlated to urban conditions within the uplands draining to each sampling site, and was significantly correlated with factors such as impervious surfaces, percentage of piped streams, road density, and percent canopy. Communities also varied with local habitat conditions such as temperature, DO, and conductivity. The City of Portland will be revising its monitoring programs into an integrated, probabilistic monitoring approach, and will be incorporating the methods evaluated through this pilot study as one component of that effort.

Keywords: Land/watershed management, Water quality

Claire Puchy[a], Lisa De Bruyckere[b]

City of Portland - Bureau of Environmental Services, 1120 SW 5th Ave, Suite 1000, Portland, OR 97204
[a]Phone: (503) 823-3045, Email: clairep@bes.ci.portland.or.us
[b]Phone: (503) 704-2884, Email: lisad@createstrat.com

Invasive animal assessment

The City of Portland is conducting an assessment to determine status and threats of invasive animals and to identify and guide management actions. This assessment will characterize invasive animals in the City of Portland; evaluate existing programs and regulatory authorities; define opportunities for collaboration; and identify high priority projects for implementation. The assessment will identify invasive terrestrial and aquatic wildlife species that are currently present, as well as those that might invade suitable habitats in the City in the next 5-10 years. The assessment includes a survey to gather input from regional experts. This work is being conducted as part of the larger statewide assessment of invasive species being conducted by the Oregon Invasive Species Council, and will address high priority tasks identified in the Portland Watershed Management Plan and the City's Terrestrial Ecology Enhancement Strategy. This assessment will serve as a template for other regional or local entities to conduct similar studies to help guide management actions. The assessment will be complete by the end of 2009 and we would like to share the results at the UERC.

Keywords: Animal ecology, Land/watershed management

David Pyle

City of Bellevue - Development Services Department, 450 110th Ave NE, Bellevue, WA 98004
Phone: (425) 452-2973, Email: dpyle@bellevuewa.gov

Bellevue's critical areas ordinance training program: Fostering environmental stewardship

Local regulation is a key component of achieving landscape-level protection of critical areas. Education can increase the understanding of critical areas functions, regulations, and permit review considerations. The City of Bellevue Development Services Department and ICF Jones & Stokes partnered to develop graphic-rich presentations and handouts to educate professionals and local landowners. This presentation discusses the goals, content, process, format and development of the training program and reviews the outcomes of the program after implementation over a one year period.

Keywords: Environmental education, Environmental policy, Land use planning

Heather Randol

City of Portland - Bureau of Environmental Services, 1120 SW 5th Ave, Suite 1000, Portland, OR 97204
Phone: (503) 206-4508, Email: heather.randol@bes.ci.portland.or.us

Accounting for green infrastructure

Portland's Bureau of Environmental Services is increasingly employing green infrastructure solutions to address stormwater management and watershed health issues. While green solutions provide numerous well-documented environmental, aesthetic, and economic benefits, trees and other green infrastructure present unique challenges in terms of accounting and financing. Trees have traditionally been viewed and managed as amenities, yet the growing recognition that they function as green infrastructure begs a number of questions: Does green infrastructure fit into existing asset management systems? Are bond proceeds appropriate funding sources for trees? Do tree planting projects belong in the Bureau's Capital Improvement Program? This presentation will address several challenges in financing large-scale tree planting projects and determining whether trees can be practicably managed as capital assets. Examples from several jurisdictions will be provided, along with a focus on the case Portland has made for managing trees as capital assets.

Keywords: Land/watershed management, Sustainable development

Gretchen Rollwagen-Bollens[a], Jennifer Duerr, Stephen Bollens[b], Alejandro Gonzales, Julie Zimmerman, Tammy Lee

Washington State University Vancouver - School of Earth & Environmental Sciences, 14204 NE Salmon Creek Ave, Vancouver, WA 98686
[a]Phone: (360) 546-9115, Email: rollboll@vancouver.wsu.edu
[b]Email: sbollens@vancouver.wsu.edu

Assessing the role of micro- and mesozooplankton grazing on the development and decline of a noxious cyanobacteria bloom in Vancouver Lake, Washington

Harmful algal blooms in urban aquatic systems are an increasing problem, and considerable effort is being targeted toward mitigating these blooms in sensitive areas. Since 2007 we have investigated the factors that influence seasonal cyanobacteria blooms in Vancouver Lake - a large, shallow, urban lake in the lower Columbia River flood plain. We are particularly interested in how zooplankton grazing may modulate and/or control the magnitude and timing of these blooms. From April to October 2008, over the course of an extremely large cyanobacteria bloom, we conducted bi-weekly dilution experiments and grazer incubation experiments to make concurrent measurements of cyanobacteria/algal growth rates, microzooplankton community grazing rates, and mesozooplankton (copepod and cladoceran) clearance and ingestion rates. From April to June algal growth rates were maximal and microzooplankton grazing rates were relatively low. By contrast, from mid-June to mid-July (immediately preceding the large cyanobacteria bloom), algal growth rates were strongly negative, suggesting conditions for algal growth had substantially degraded. Algal growth rates rapidly increased to maximal rates at the beginning of the cyanobacteria bloom, and remained high during the bloom from late July to early September. However zooplankton grazing rates also increased markedly as the bloom progressed, such that by the end of the bloom grazing rates were approximately equal to algal growth rates. This suggests grazers may have contributed to the rapid decline in cyanobacteria abundance by the end of September. These experimental results demonstrate that zooplankton grazing may play an important role in the development and decline of a cyanobacteria bloom.

Keywords: Water quality

Gretchen Rollwagen-Bollens[a], Stephen Bollens[b], Brian Tissot, Tamara Nelson, Anne Kennedy, Bonnie Lock

Washington State University Vancouver - School of Earth & Environmental Sciences, 14204 NE Salmon Creek Ave, Vancouver, WA 98686
[a]Phone: (360) 546-9115, Email: rollboll@vancouver.wsu.edu
[b]Email: sbollens@vancouver.wsu.edu

Partners in Discovery GK-12 project at WSU Vancouver: Bridging research and teaching about the Columbia River - from Cascades to coast

The "Partners in Discovery of the Columbia River Watershed" GK-12 project pairs WSU Vancouver Environmental Science graduate students (Fellows) with 6^{th}-9^{th} grade science teachers in 3 SW Washington school districts for year-long, one-on-one partnerships. Our goals are to bring the Fellows' research and expertise into the classroom and to support the Fellow-teacher partners as they teach science through authentic inquiry, particularly to connect kids to their local environment. The GK-12 Fellows' research is already focused in the Columbia River watershed, and each works with their partner teacher to integrate their research into the curriculum. For example, Laura Friedenberg (Fellow) and Jennifer Dean (9^{th} grade biology) developed a water quality laboratory and field unit oriented around Laura's research on larval fish feeding. Ray Yurkewicz (Fellow) and Meagan Graves (6^{th} grade earth science) emphasized systems, using Ray's research on how burrowing gophers influence nutrient cycling and plant community structure on Mt. St. Helens. Jennifer Blaine (Fellow) utilizes submersibles to study impacts of marine protected areas on benthic invertebrates. She and Jeremy Ecklund (7^{th}/8^{th} grade science) developed a set of lessons integrating water pressure, mechanics of vessel operations, and community ecology. Jennifer Duerr (Fellow) and Charlene Shea (7^{th} grade life science) designed an ecosystem unit focused on energy flow and food webs, and connected it to Jennifer's research about harmful algal blooms in a local, urban lake system. We are assessing the impact of these partnerships on the Fellows' communication skills, teachers' inquiry skills, and on students' enthusiasm for and knowledge of science.

Keywords: Environmental education

Chris Runyard

Phone: (503) 239-5844, Email: crunyard@msn.com

Plastic waters

Plastic is a substance that does not biodegrade. For decades now, we have been not only planting millions of trees in our watersheds, but surrounding them with plastic tubes and marking them with PVC flagging tape. What is the result of all this? The presentation will look at our 20 year cumulative experience with plastic in the wetland and the authors 15 years of experience installing and removing the material. Where does it end up? 800 years after we plant the Red Cedar, is the plastic tube really still in the environment? Are we adding to the "plastic island" in the middle of the Pacific Ocean when we install a tube around an Ash seedling? Are there ways to protect our little trees and not harm the natural world? What about weed mats? Burlap coffe bags, poly fibers? Plastic waddles? This presentation is based on gathering experience from reforestation professionals, side by side comparisons, constant monitoring and plastics research. We aim to start an ongoing discussion about our use and need for plastic so we can grow healthy restoration projects.

Keywords: Habitat restoration, Water quality

John Sheehan

Metro - Sustainability Center, 600 NE Grand Ave, Portland, OR 97232
Phone: (503) 797-1733, Email: john.sheehan@oregonmetro.gov

Oregon's environmental literacy plan: What it is and where we stand

In 2009 the Oregon legislature passed legislation creating the Oregon Environmental Literacy Task Force and directing it to create an Oregon environmental literacy plan. The task force has until October 2010 to create a plan that will establish statewide EE curriculum content standards, graduation requirements and teacher training; define the terms "environmental literacy," "climate change" and "healthy lifestyles;" and propose a funding and implementation strategy. John Sheehan, Metro Community Involvement Program manager and Oregon Environmental Literacy Task Force member, provides an update on progress towards these goals. He also discusses the implications of the emerging environmental literacy plan for the larger conservation community.

Keywords: Environmental education

Trevor Sheffels[a], Mark Sytsma[b]

Portland State University - Environmental Science & Management, PO Box 751- ESM, Portland, OR 97207
[a]Phone: (503) 725-9076, Email: sheffels@pdx.edu
[b]Email: sytsmam@pdx.edu

Nutria (*Myocastor coypus*) herbivory mitigation at a habitat restoration site within the Delta Ponds wetland complex in Eugene, Oregon

We studied the impact of nutria (*Myocastor coypus*) herbivory within a regional wetland restoration site and the use of plastic mesh protection tubes to mitigate damage. Black cottonwood (*Populus balsamifera*), red osier dogwood (*Cornus sericea*), and willow (*Salix* spp.) live stakes were installed and submitted to protected and unprotected treatments. Video surveillance showed that nutria frequently targeted newly planted live stakes and were more active in unprotected plots. The daily rate of nutria activity increased shortly after vegetation installation, then decreased as the supply of unprotected live stakes was depleted. Protected stakes demonstrated 100% survival, while only 12% of unprotected stakes survived over a 14-week period. Nutria displayed a preference for black cottonwood over other species. Results suggest that regional managers should account for nutria herbivory potential when selecting woody restoration species and consider the use of plastic mesh protection tubes as a mitigation tool. Future studies could evaluate the plastic mesh protection tubing over a longer time period to determine if factors such as limited nutria food availability and harsh weather conditions reduce the effectiveness of this tool in mitigating nutria herbivory damage.

Keywords: Animal ecology, Habitat restoration
Website: www.clr.pdx.edu/projects/ans/nutria.php

Brook Silver[a], Jennifer Poirier[b], Jeff Johnson[c], Tim Whitesel[d], Michael Hudson[e]

U.S. Fish and Wildlife Service - Columbia River Fisheries Program Office, 1211 SE Cardinal Ct., Suite 100, Vancouver, WA 98683
[a]Phone: (360) 604-2500, Email: brook_silver@fws.gov
[b]Phone: (360) 604-2500, Email: jennifer_poirier@fws.gov
[c]Phone: (360) 604-2500, Email: jeff_johnson@fws.gov
[d]Phone: (360) 604-2500, Email: timothy_whitesel@fws.gov
[e]Phone: (360) 604-2500, Email: michael_hudson@fws.gov

Tryon Creek restoration monitoring of fish distribution, abundance and connectivity

Tryon Creek is located in southwest Portland. It remains one of the largest, relatively protected urban watersheds in Oregon. In August, 2008, a 400 ft culvert extending under Highway 43 was retrofit with a new baffle system intended to improve the upstream migration of fish in Tryon Creek. The U.S. Fish and Wildlife Service is leading an ongoing project to evaluate the effectiveness of restoration actions on the fish populations. The objectives are to determine whether adult and juvenile fish can successfully enter and pass through the culvert, to determine the efficiency of fish passage through the culvert, and to estimate the abundance of fish species above the culvert. Fish were captured above and below the culvert using a backpack electrofisher. Movement of fish through the culvert was monitored with PIT tag antenna arrays and spawning ground surveys. To date, coastal cutthroat trout, *Oncorhynchus mykiss*, their hybrids, coho and Chinook salmon have been captured upstream and downstream of the culvert. Estimated abundance of trout species above the culvert in fall 2008 was 1,054 +/- 68.36 fish. PIT tag antenna arrays have detected coastal cutthroat trout, *O. mykiss*, and their hybrids, which were originally tagged downstream of the culvert, passing upstream through the culvert. Continued monitoring will provide a better understanding of fish species within the system, and how culvert improvements benefit fish species and their ability to migrate upstream in Tryon Creek.

Keywords: Fisheries, Habitat restoration
Website: http://www.fws.gov/columbiariver/programs/nativetrout/tryon_creek.html

Max Smith

USDA Forest Service Rocky Mountain Research Station and Oklahoma Biological Survey, 6859 NE Vinings Way #736, Hillsboro, OR 97124
Phone: (503) 720-9730, Email: oregonmax@gmail.com

Monitoring Willow Flycatchers at Killin Wetlands: Implications for habitat restoration

The Willow Flycatcher (*Empidonax traillii*) is among several species of Neotropical migrant birds that have declined in the Portland metro region. Information on the breeding biology of this species is needed to restore its nesting habitat. During the summer of 2009, I began a study, in collaboration with Metro, of Willow Flycatchers at Killin Wetlands. Our objectives were to estimate the number of territorial males and identify spatial and vegetative features influencing habitat selection. We monitored flycatchers in two sections of the wetland that differed in their stages of restoration. With assistance from the Audubon Society of Portland's Important Bird Area Monitoring Program, I conducted weekly point counts and area searches for flycatchers during late spring and early summer. I also quantified variation in habitat by measuring composition and structure of vegetation in both sections. The number of singing males peaked at five during late June. Four of the five males occupied the northern section of the wetland where shrub cover, willow density, and canopy height were greater than in the southern section. Exotic reed canary grass (*Phalaris arundinacea*) density and height were greatest in the southern section, which also had lower water depth than the northern section. Future analyses will compare habitat variables of territories with locations not selected for use by flycatchers. We will use this information to identify areas where we can control growth of reed canary grass to increase shrub cover and Willow Flycatcher occupancy.

Keywords: Habitat restoration, Land/watershed management, Wildlife biology

Robert Spurlock

Metro - Sustainability Center, 600 NE Grand Ave, Portland, OR 97232
Phone: (503) 813-7560, Email: robert.spurlock@oregonmetro.gov

Habitat-sensitive trail planning

Metro and local agencies are working to connect the gaps in the region's network of off-street trails. The undeveloped areas through which many of these trail connections are planned often serve as important habitat for sensitive species. Since Metro's work includes protecting sensitive habitat and completing the regional trail network, staff decided to proactively address these competing interests by developing a process for planning trail alignments with sensitive habitat in mind. In July 2009, Metro held two workshops focusing on a 2-mile regional trail gap on the edge of the urban growth boundary. Metro ecologists and park planners worked together to identify a preferred trail alignment based on several factors, including land ownership, user experience, and habitat quality. Results of the exercise will inform the upcoming master plan process for the trail. The process will be repeated for other natural areas around the region.

Keywords: Sustainable development, Transportation

Elaine Stewart

Metro - Sustainability Center, 600 NE Grand Ave, Portland, OR 97232
Phone: (503) 797-1515, Email: Elaine.Stewart@oregonmetro.gov

Ecological performance measures for natural area acquisitions

A 2006 bond measure provided $227.4 million to safeguard water quality, protect fish and wildlife habitat and ensure access to nature for future generations. An independent citizen oversight committee was formed to review the Natural Areas Program and to inform the Metro Council and citizens of its findings. Oversight Committee members and Metro staff created performance measures to evaluate regional land acquisitions against identified goals and present the information in an easily understood format. Of the 11 performance measures, six focus on water quality and wildlife habitat benefits; the other five focus on public and financial benefits (e.g., scenic values, price relative to market value). Although the measures rank acquisitions' value on a qualitative scale, the water quality and wildlife habitat benefits are science-based and incorporate local data and literature on species and habitats in our region. These six ecological measures are water quality, existing or potential wildlife habitat quality, rare habitats and species, fish habitat, habitat area size and wildlife connectivity. Each acquisition is scored low, medium or high for each metric; the measures can be applied to multiple acquisitions and updated as new information becomes available or key nearby parcels are acquired. By condensing complex information into a ranking system, the performance measures convey important information to non-technical audiences simply and consistently.

Keywords: Environmental social sciences, Water quality, Wildlife biology

Suzanne Tomassi

The Watershed Company, 750 Sixth Street S, Kirkland, WA 98033
Phone: (425) 822-5242, Email: stomassi@watershedco.com

Creating a functional assessment form for urban habitat

No simple, science-based tool for assessing the value of non-wetland, non-stream wildlife habitat in urban and urbanizing areas is readily available for our area. The City of Bellevue hired The Watershed Company to develop a means of documenting non-critical-area habitat in a quantitative, reproducible way so that the presence of wildlife habitat and potential habitat could be addressed during the permitting process. The overall goals are to give regulatory consideration to presently unprotected or poorly protected habitat when land use decisions are made, and to base habitat conservation and management actions on pertinent, existing needs on a site-specific basis. Using recent literature and input from local experts, primarily from the Pacific Northwest, we determined the factors that most often impact wildlife populations and communities in developing landscapes. We developed a process to characterize the present level of development on a parcel, property, or other urban or urbanizing site; to determine the extent to which opportunity to provide habitat for wildlife exists; and to rate the ability of the site to support wildlife. This is accomplished through the use of a form consisting of questions and measurements regarding first landscape-scale attributes followed by site-specific parameters. The analysis generates a number that can be compared to other results or evaluated on an absolute scale. Depending on the responses to individual questions on the form, site-specific management and mitigation strategies can be applied to promote meaningful protection and enhancement of ecological processes and habitat functions.

Keywords: Environmental policy, Habitat restoration, Land use planning

Naomi Tsurumi[a], Anne Nelson[b]

City of Portland - Bureau of Environmental Services, 1120 SW 5th Ave, Suite 1000, Portland, OR 97204
[a]Phone: (503) 823-4886, Email: naomit@bes.ci.portland.or.us
[b]Phone: (503) 823-2584, Email: anne.nelson@bes.ci.portland.or.us

Tabor to the River: Integrating grey and green infrastructure

The City of Portland, Bureau of Environmental Services (BES) is taking a unique approach to addressing sewer system and watershed deficiencies within a 1,500-acre area of the City. The cornerstones of BES' 15-year, $81 million Tabor to the River (T2R) Program include 500 sustainable stormwater facilities, 80,000 linear feet of pipe, 3,500 street trees, private property stormwater retrofits, revegetation and invasive plant removal and a targeted public outreach & education effort. The green approach of the T2R Program saves the City $60 million over an all-pipe solution. The cost estimate of this watershed-based solution is $81 million, compared to a $144 million investment needed to construct an all-pipe solution. Using stormwater infiltration facilities not only supports sewer capacity by reducing flow volumes, but also provides watershed health benefits such as groundwater recharge, pollutant removal and added vegetation that improves urban habitat conditions. The T2R Program is now in its second year of implementation. A comprehensive outreach program creates new partnerships with PSU and other organizations and leverages existing City program resources to inform, engage, motivate and partner with the community to manage stormwater as a resource and take responsibility for overall watershed health. 150 street trees have been planted. Private property stormwater retrofit agreements are being made. Plans for a revegetation project at Mt. Tabor Park are developed. In the next 6 months, the first 40 stormwater infiltration facilities will be constructed, 210 more street trees will be planted, private property retrofits will be constructed, and comprehensive outreach will continue.

Keywords: Hydrology, Land/watershed management, Sustainable development
Website: http://www.portlandonline.com/bes/tabortoriver

Daniel Uthman

Portland State University - Geography, 1721 SW Broadway, Portland, OR 97201
Phone: (202) 316-2798, Email: dan.uthman@gmail.com

Spatial distribution of wildlife in the City of Portland

As human populations grow and urban development extends into previously undeveloped areas, human and wildlife habitats have increased proximity and contact. At the same time, wildlife has remained in place or migrated into urban areas, whether to seek shelter, food or other resources. This project seeks to answer the question of where the greatest density of certain wildlife can be found in the City of Portland. The study mainly focuses on three species: raccoons, opossums and skunks. Unlike a zoo, there is not a system of 24-hour surveillance of wildlife in Portland that can provide the locations of wild animals at any time. In order to affix locations to wildlife presence or habitat in the city, I am using the appropriate reports submitted to the Audubon Society of Portland and Oregon Department of Fish & Wildlife. These reports, which have never been compiled in a geographic information system (GIS), include address data for cases involving private residences or commercial or public buildings. Once collected, the data is entered into ArcMap to do a GIS analysis of the spatial distribution. The goal is to discover patterns or locations of habitat for wildlife species in the urban landscape, with the idea that this could be useful for improving general ecology or developing wildlife corridors or passages in the urban setting.

Keywords: Animal ecology

Maya Villarreal

AMEC Earth & Environmental, 7376 SW Durham Ave, Portland, OR 97224
Phone: (503) 639-3400, Email: maya.villarreal@amec.com

Ecological restoration at a remediated site

Contaminated sites and their remediation often degrade ecological functions and values. The Oregon Military Department and scientists from AMEC Earth & Environmental, Inc. recently completed a soil remediation and ecological restoration project at a 12-acre training area of a 253-acre site containing former Small Arms Firing Ranges located in Clackamas, Oregon. The purpose of the project was to remediate lead contamination and to restore and enhance the ecological functions of various habitats within the 12-acre area, including freshwater wetlands, grasslands, migratory pathways, and forests, while ensuring that ecological improvements were compatible with the surrounding environment. The overall approach incorporates long-term environmental stewardship principles into both the remediation and restoration design. Ecological enhancements were designed as functional elements of the erosion control and stormwater management designs. For example, erosion control measures addressed both potential short-term construction and long-term site impacts by hydroseeding and planting with native species, applying biodegradable geotextile materials, irrigating with water recycled from the soil treatment facility, and incorporating wildlife habitat features into the post-construction slope protection plan. Specific methods to foster ecological restoration included: managing invasive species; installing snags and brush piles; constructing wetland bioswales to improve water quality and groundwater recharge; improving aesthetics by creating a more natural environment with spatial variation; and providing opportunities for future community education and recreation. Long-term improvements included developing vegetation management and site monitoring plans. This project demonstrates opportunities to incorporate ecological enhancements into site remediation design and implementation.

Keywords: Habitat restoration, Soil science, Sustainable development

Alan Yeakley[a], Kate Norton

Portland State University - Environmental Science & Management, PO Box 751- ESM, Portland, OR 97207
[a]Phone: (503) 725-8040, Email: yeakley@pdx.edu

Assessment of rainwater detention structures for an urban development in Wilsonville, Oregon

Three types of low-impact development (LID) rainwater detention structures were tested using simulated storms and ambient rainfall spanning both dry and wet seasons. The structures included stormwater planter boxes (n=12), extensive ecoroofs (n=2) and a 93 m^2 section of porous pavement. Planter boxes varied with respect to soil depths (n=2), soil mixes (n=2) and the use of a fabric filter, resulting in 6 unique planter box types, each with 2 replicates. Results showed that water retention varied from 0% to 59% for the stormwater planter boxes over 72 separate storms, with a median retention of 20%. Lag time between the centroids of input and output flow varied from 1.7 min to 29.9 min, with a mean lag time of 12.8 min. In general, planter box configurations with a finer, less porous soil mix with no fabric filter produced the largest stormwater retention and the longest delay in transmission of stormwater. For planter box water quality, mean specific conductivity increased by 27 µS/cm, and mean water temperature decreased by 1.9 °C. Ecoroof water retention varied greatly, from 0% to 100%, with a negative exponential relationship found between water retention % and storm duration (adj $R^2 = 0.41$, $p<0.01$). Porous pavement storm simulations showed >99% retention for 3 storms, while not performing as well during 3 other storm simulations due to clogging. Overall this study found that all three LID structures, stormwater boxes, ecoroofs and porous pavement, hold promise for a significant reduction in stormwater in urban and suburban neighborhoods.

Keywords: Hydrology, Land/watershed management, Sustainable development

Meghan Young

Portland Parks & Recreation - Environmental Education, 2909 SW 2nd Ave, Portland, OR 97201
Phone: (360) 628-1191, Email: frogsinportland@gmail.com

Pond-breeding amphibians in the city: Occurrence, influential factors, recommendations, and educational outreach in Portland, Oregon

In 2008 a study of pond-breeding amphibians was conducted in 21 natural areas within three different watersheds in the city of Portland. A total of 59 ponds were surveyed to assess the following questions: 1) What amphibians are present in Portland and in what densities? 2) What factors are influential for amphibians in Portland? 3) How can we effectively conduct habitat conservation and restoration to benefit amphibian populations? During the 2009 season, a total of 83 ponds were surveyed using the same methodology & protocols as the 2008 season. Results from this season included the presence of six species of pond-breeding amphibians, represented by 3 frog and 3 salamander species. Specific factors, such as pH, nitrates, % refuge and aquatic vegetation were found to affect amphibian populations. For the 2010 breeding season, in addition to generating a third year of consecutive data, the following questions will be introduced: 1) What aquatic plants are important attachment species for amphibian egg masses? 2) What aspects of an ecosystem will be most beneficial in the creation of new ponds? 3) Where is *Chytridiomycota* found and what are the negative implications of this fungus? Goals for 2010 include: coordinating with other organizations to synchronize data collection methods to create a region-wide amphibian database, organizing volunteer field trainings, continuing popular bull frog round-up events, and exploring partnerships with elementary schools and citizen scientists interested in "adopting" research sites to assist in data collection and in promoting healthy amphibian habitats and populations.

Keywords: Conservation biology, Environmental education, Habitat restoration

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